PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

Pacific Lamprey Research And Restoration

BPA project number: 9402600
Contract renewal date (mm/yyyy): ☐ **Multiple actions?**

Business name of agency, institution or organization requesting funding
Confederated Tribes of the Umatilla Indian Reservation

Business acronym (if appropriate) CTUIR

Proposal contact person or principal investigator:

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NPPC Program Measure Number(s) which this project addresses
7.5F.1

FWS/NMFS Biological Opinion Number(s) which this project addresses
n/a

Other planning document references
Wy-Kan-Ush-Mi Wa-Kish-Wit, 1995, Volume 2. Recommended actions under John Day, Umatilla, Walla Walla, Grande Ronde, Tucannon subbasin restoration plans.
Status Report of the Pacific Lamprey in the Columbia River Basin, 1995.

Short description
Assess status and survival limitations of Pacific lamprey in the Umatilla, Walla Walla, John Day, Tucannon, Grande Ronde basins. Implement and monitor restoration plan developed for the Umatilla River.

Target species
Pacific lamprey

Section 2. Sorting and evaluation

Subbasin
John Day, Umatilla, Walla Walla, Tucannon, Grande Ronde, and mainstem Columbia Rivers.

Evaluation Process Sort

CBFWA caucus	Special evaluation process	ISRP project type
Mark one or more caucus	If your project fits either of these processes, mark one or both	Mark one or more categories
☒ Anadromous fish ☐ Resident fish ☐ Wildlife	☐ Multi-year (milestone-based evaluation) ☐ Watershed project evaluation	☐ Watershed councils/model watersheds ☐ Information dissemination ☐ Operation & maintenance ☐ New construction ☒ Research & monitoring ☒ Implementation & management ☐ Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
8902401	Evaluate juvenile salmonid outmigration and survival in the Umatilla River	outmigration study will capture lamprey smolts and provide data necessary for monitoring success of lamprey restoration in Umatilla River.
8802200	Umatilla Fish Passage Operations	passage project provides for improved salmonid and lamprey migration in the Umatilla River.

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?
1995	Status report of lamprey in Columbia Basin.	
1996	Assessment of radio tag use for lamprey.	
1998	Completed sampling for Columbia Basin lamprey genetic database.	
1998	Began development of Umatilla Basin lamprey restoration plan.	
1998	Assessment of past and current lamprey abundance in NE Oregon subbasins.	

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Determine abundance and passage trends of adult lamprey crossing mainstem Columbia and Snake River dams.	a	Coordinate exiting efforts to count adult lamprey at mainstem dams.
		b	Standardize counts at mainstem dams.
		c	Coordinate implemention of night counts.
		d	Assist in lamprey passage research
		e	Estimate lamprey numbers at John Day Dam by mark/recapture and compare to window counts.
2	Continue developing the Pacific lamprey restoration plan for the Umatilla River in NE Oregon.	a	Compile existing information regarding supplementation, disease, genetics and pheromones.
		b	Continue to add new information from ongoing studies.
3	Conduct pilot tests to address critical uncertainties and begin implementation of the Umatilla River Pacific lamprey restoration plan .	a	Collect adults, hold adults, spawn adults, incubate eggs to prolarvae, outplant larvae.
		b	Monitor and evaluate methods.
		c	Validate aging methods.
		d	Determine petromyzonol sulfate levels in Umatilla and John Day Rivers.

		d	Estimate smolt yield in Umatilla River.
4	Document current presence and distribution of larval lamprey in the John Day, Grande Ronde, Tucannon, Walla Walla Basins for future restoration plans.	a	Conduct electrofishing and document lamprey presence and relative abundance.
		b	conduct trapping on John Day River
		c	continue monitoring water samples for analysis of petromyzonol sulfate.

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	1/2000	12/2000			20.00%
2	1/2000	12/2000			10.00%
3	1/2000	12/2000			50.00%
4	1/2000	12/2000			20.00%
				Total	100.00%

Schedule constraints
The final Umatilla River lamprey restoration plan has not been completed or agreed to by ODFW. Approval is expected in 1999 for action in 1999 or 2000. Any delay in plan approval may constrain proposed schedule.

Completion date
N/A-on going project

Section 5. Budget

FY99 project budget (BPA obligated): $320,000

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel	FTE=4.25	%39	150,000
Fringe benefits	29%	%11	43,500
Supplies, materials, non-expendable property		%5	20,000
Operations & maintenance		%0	
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		%0	

NEPA costs		%0	
Construction-related support		%0	
PIT tags	# of tags:	%0	
Travel		%4	15,000
Indirect costs	@34%	%20	77,690
Subcontractor		%20	75,000
Other		%0	0
TOTAL BPA FY2000 BUDGET REQUEST			$381,190

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
		%0	
		%0	
		%0	
		%0	
Total project cost (including BPA portion)			$381,190

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	$408,000	$430,000	$450,000	$475,000

Section 6. References

Watershed?	Reference
☐	Anglin, D.R., W.J. Ambrogetti, and C.L. Burley. 1979. A preliminary study to determine feasible methods of harvesting adult lamprey in the Columbia River. USFWS. Vancouver, Washington. 23 p.
☐	Beamish, R.J., and C.D. Levings. 1991. Abundance and freshwater migrations of the anadromous parasitic lamprey, Lampetra tridentata, in a tributary of the Fraser River, British Columbia. Can. J. Fish. Aquat. Sci. 48:1250-1263.
☐	Beamish, F.W.H., and T.E. Medland. 1988. Age determination for lampreys. Tran. Amer. Fish. Soc. 117:63-71.
☐	Bergstedt, R.A., and J.G. Seelye. 1995. Evidence for lack of Homing by sea lampreys. Trans. Amer. Fish. Soc. 124:235-239.
☐	Brussard, P.F., M.C. Hall, and J. Wright. 1981. Structure and affinities of freshwater sea lamprey (Petromyzon marinus) populations. Can. J. Fish. Aquat. Sci. 38:1708-1714.
☐	Close, D.A., M. Fitzpatrick, H. Li, B. Parker, D. Hatch, and G. James. 1995.

	Status report of the Pacific lamprey (Lampetra tridentata) in the Columbia River Basin. Report (Contact No. 95BI39067) to Bonneville Power Administration, Portland, Oregon.
☐	Farlinger, S.P., and R.J. Beamish. 1984. Recent colonization of a major salmon producing lake in British Columbia by the Pacific lamprey (Lampetra tridentata). Can. J. Fish. Aquat. Sci. 41:278-285
☐	Fredricks, K.T., and J.G. Seelye. 1995. Flowing recirculated-water system for inducing laboratory spawning of sea lampreys. The Progressive Fish-Culturist. 57:297-301.
☐	Hammond, R.J. 1979. Larval biology of the Pacific lamprey, Entosphenus tridentata (Gardiner), of the Potlatch River, Idaho. M.Sc. thesis. University of Idaho, Moscow, Idaho. U.S.A. 44 pp.
☐	Jackson, A.D., P.D. Kissner, D.R. Hatch, B.L. Parker, D.A. Close, M.S. Fitzpatrick, and H. Li. 1997. 1996 Pacific Lamprey Research and Restoration annual report. BPA, Project No. 94-026
☐	Jackson, A.D., D.R. Hatch, B.L. Parker, D.A. Close, M.S. Fitzpatrick, and H. Li. 1998. 1997 Pacific Lamprey Research and Restoration annual report. BPA, Project No. 94-026
☐	Jebbink, J.A., and F.W.H. Beamish. 1995. Prspectus on the use of statoliths for age determination in lampreys. in Recent developments in fish otolith research. edited by D.H. Secor, J.M. Dean, S.E. Campana, and A.B. Miller. pp. 331-339.
☐	Kan, T.T. 1975. Systematics, variation, distribution, and biology of lampreys of the genus Lampetra in Oregon. Doctoral Dissertation, Oregon State University, Corvallis, Oregon. 194p.
☐	Li, W., P.W. Sorensen, and D.D. Gallaher. 1995. The olfactory system of migratory adult sea lamprey (Petromyzon marinus) is specifically and acutely sensative to unique bile acids released by conspecific larvae. J. Gen. Physio. 105:569-587.
☐	Manion, P.J., and L.H. Hanson. 1980. Spawning behavior and fecundity of lampreys from the upper Great Lakes. Can. J. Fish. Aquat. Sci. 37:1635-1640.
☐	Manion, P.J., and A.L. McLain. 1971. Biology of larval sea lampreys (Petromyzon marinus) of the 1960 year class, isolated in the Big Garlic River, Michigan, 1965-69. Great Lakes Fishery Commission. Report 15. 35pp.
☐	Medland, T.E., and F.W.H. Beamish. 1991. Lamprey statolith banding patterns in response to temperature, photoperiod, and ontogeny. Tran. Amer. Fish. Soc. 120:255-260.
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☐	Mullan, J.W., M.B. Dell, S.G. Hays, and J.A. McGee. 1986. Some factors affecting fish production in the Mid-Columbia River 1934-1983. U.S.F.W.S. Report No. FRI/FAO-86-15
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☐	Purvis, H.A., and R.B. MacDonald. 1987. Summary of evaluation methods and population studies of spawning phase sea lamprey. In: Workshop to

	evaluate sea lamprey populations. Edited by B.G.H. Johnson. Great Lakes Fishery Commission. no.87-2, 231p.
☐	Starke, G.M., and J.T. Dalen. 1995. Pacific lamprey (Lampetra tridentata) passage patterns past Bonneville Dam and incidental observations of lamprey at the Portland district Columbia River Dams in 1993. U.S.C.O.E. CENPP-OP-PF. Bonneville Lock and Dam.
☐	Van de Wetering, S.J. 1998. Aspects of life history characteristics and phsiological processes in smolting Pacific lamprey, Lampetra tridentata, in a Central Oregon coast stream. M.Sc. thesis. Oregon State University, Corvallis, Oregon. USA., 58 pp.
☐	Vella, J.J., and L.C. Struehrenberg. 1996. Migration patterns of Pacific lamprey (Lampetra tridentata) in the lower Columbia River, 1996. U.S.C.O.E, Annual Report of Research, Portland, Or.
☐	Vella, J.J., and L.C. Struehrenberg. 1997. Migration patterns of Pacific lamprey (Lampetra tridentata) in the lower Columbia River, 1997. U.S.C.O.E, Annual Report of Research, Portland, Or.
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☐	Weisser, J.W. 1994. Response of larval sea lamprey (Petromyzon marinus) to electrical stimulus. M.S. thesis. Northern Michigan University. Marquette, Michigan. 144 p.
☐	Whyte, J.N.C., R.J. Beamish, N.G. Ginther, and C.E. Neville. 1993. Nutritional condition of the Pacific lamprey (Lampetra tridentata) deprived of food for periods of up to two years. Can. J. Fish. Aquat. Sci. 50:591-599.

PART II - NARRATIVE

Section 7. Abstract

The Pacific Lamprey Research and Restoration Project began in 1994 as a cooperative effort between CTUIR, CRITFC, and OSU. A Pacific lamprey status report, (Close et al. 1995) determined that Pacific lamprey populations were generally depressed in mid to upper Columbia and Snake River tributaries. The report recommends research and management actions to restore populations. An initial recommendation was to determine past and current distribution and abundance of lamprey in the Columbia River Basin. Limiting factors of Pacific lamprey continue to be identified, and restoration plans will be developed and implemented for NE Oregon/SE Washington rivers. Lamprey counts were discontinued at USCOE Portland District hydroprojects in 1969. In 1997, CTUIR requested that adult lamprey counts resume. Adult counts are monitored at several mainstem Columbia and Snake River dams to assess populations status and trends.

Through historical information, interviews, compilation of recent fish sampling, screening records, and site sampling, data indicates that lamprey popultions that were previously abundant but are now at critically low levels. General habitat conditions in

tributaries continue to be compared to presence/absence, densities and distribution to better understand lamprey habitat preference. In 1996, 1997, and 1998 OSU assessed the stress response in Pacific lamprey to further evaluate lamprey tagging techniques and resultant stress for application in passage research. In 1998, genetic sampling of Pacific lamprey from rivers and tributaries of the Columbia River Basin was conducted to examine temporal and spacial genetic structure. The results of the genetic study will be complete in the spring of 1999. These are the first samples of a genetic database for Columbia River Basin Pacific lamprey. All information will be considered in developing and implementing subbasin lamprey restoration plans. During 1998, a study was initiated to investigate Pacific lamprey homeing behavior. We also have found petromyzonol sulfate in Pacific and western brook lamprey, already established as a migratory cue in adult sea lamprey. A restoration plan was initiated in 1998, for the Umatilla River. The plan relies on research and continues to be developed. Coordination with ODFW and other agencies in the development of the plan continues. A multi-agency lamprey technical work group has been formed to discuss various questions and needs regarding lamprey restoration. In FY 2000, we will continue to work on mainstem issues such as dam counts, population estimates, and coordinate with the University of Idaho to evaluate new mainstem passage methods for adult Pacific lamprey. We are integrating new knowledge with regards to genetics, disease, pheromones, and supplementation. We are implementing initial actions in the plan to test hypotheses relating to restoration uncertainties (e.g. supplementation).

Section 8. Project description

a. Technical and/or scientific background

The once-abundant Pacific lamprey (*Lampetra tridentata*) populations are believed to be severely depressed or absent in mid upper Columbia and Snake River tributaries where hydroelectric projects have created serious migration impacts (Close et al. 1995; Vella and Stuehrenberg 1996; 1997; 1998). The Pacific lamprey is an important part of the food web of north Pacific ecosystems, both as predator and prey. Lampreys are also a valuable food and cultural resource for American Indians of the Pacific Northwest. Depressed upriver lamprey runs have impacted treaty-secured fishing opportunities by forcing tribal members to gather this traditional food fish in lower Columbia River locations (Close et al. 1995). State, Federal, and Tribal agencies have also voiced concerns for Pacific lamprey. In 1993, ODFW designated Pacific lamprey at risk of being listed as threatened or endangered. During 1994, the USFWS designated Pacific lamprey as a category 2 candidate species. The tribes have been concerned about lamprey declines (Close et. al. 1995; Jackson et al. 1998) and the lack of harvest opportunities in the Columbia Basin for years (Anglin et al. 1979). To date, little attention has been given to assessment of lamprey populations, documentation of impacts, or the potential of enhancement efforts for this species. The NPPC Fish and Wildlife Program supports lamprey restoration following identification of problems and plans to do so. The NPPC approved the Status Report in 1995 that initiated research and restoration in the Columbia River Basin.

The goal of this project is to identify Pacific lamprey enhancement opportunities and implement projects to bring back lamprey to the Columbia and Snake River tributaries. Historic and current populations and distribution will be documented to identify losses. Analysis of limiting factors (including assessment of mainstem passage problems) will be conducted on representative populations to identify problems. Upon determining limiting factors, and restoration techniques, CTUIR will enhance and or restore lamprey in NE Oregon and SE Washington streams.

b. Rationale and significance to Regional Programs

This project represents the first effort in the Columbia River Basin to restore Pacific lamprey in a specific subbasin. The experimental procedures implemented and evaluated in the Umatilla Basin (pilot subbasin) will provide valuable information to other tributary lamprey restoration efforts throughout the region. In addition, lamprey restoration in tributaries will result in significant benefits to the ecosystem and the regions native American peoples regarding traditional use and cultural/religious values.

c. Relationships to other projects

This project provides regional coordination of lamprey activities through annual technical work group meetings. These meetings bring together all groups interested in conducting research and monitoring. All salmonid restoration projects in the Umatilla River Basin pertaining to fish passage , flow enhancement, and habitat enhancement are the basis for selecting the Umatilla River as a Pilot location to begin lamprey restoration. In addition, the existing salmonid monitoring and evaluation projects in the Umatilla Basin will likely provide lamprey information which will be useful for this project. This project does duplicate lamprey efforts which may be proposed in areas outside the geographic scope of work for this project (NE Oregon and SE Washington).

d. Project history (for ongoing projects)

The CTUIR Pacific Lamprey Research and Restoration Project # 9402600 was initiated in 1995. The NPPC required initial development of a Columbia Basin lamprey status report prior to funding continuing efforts. The status report documented that the once-abundant Pacific lamprey populations are severely depressed or absent in mid to upper Columbia and Snake River tributaries due mainly to hydroelectric projects and other habitat alterations. The report pointed out the cultural and treaty fishing value of the lamprey to Indian people and that depressed upriver runs have forced the tribes to gather this traditional food fish in the lower Columbia area. The status report also contained a list of recommendations to begin immediate protection of lamprey populations and objectives to begin lamprey research and restoration efforts. These recommendations were initiated in 1996 and continue today. Recommendations included abundance monitoring at mainstem dams, assessment of past and current lamprey distribution, assessment of limiting factors. Oregon State University provided assessment of radiotagging techniques and tools for application in passage research. In 1998, an effort was made to provide evidence of homing behavior in the mainstem Columbia and

Willamette rivers. Also, development of a genetic database for the Columbia River Basin Pacific lamprey was initiated. During the Fall of 1998, CTUIR began development of a pilot subbasin lamprey restoration plan in the Umatilla Basin.

e. Proposal objectives

Objective 1: Determine abundance and passage trends of adult lamprey crossing mainstem Columbia and Snake River dams.

Objective 2: Continue to develop a Pacific lamprey restoration plan for the Umatilla River in NE Oregon.

Objective 3: Conduct pilot tests to address critical uncertainties and begin implementation of the Umatilla River Pacific lamprey restoration plan.

Objective 4. Document current presence and distribution of larval lamprey in the John Day, Grande Ronde, Tucannon, and Walla Walla subbasins to assist in future development of restoration plans.

f. Methods

Objective 1: Determine abundance and passage trends, of adult lamprey crossing mainstem Columbia and Snake River dams.

Approach: We propose to improve dam counts of adult lamprey, evaluate alternate passage system, and conduct a mark/recapture study. Adult lamprey counts at mainstem hydroprojects will be used as an index of abundance to help assess the status of Pacific lamprey. Currently, Washington Department of Fish and Wildlife makes lamprey passage counts at most hydroprojects in the Columbia River Basin. However, a significant portion of the Pacific lamprey run traverses the fish ladders at night when counting is not conducted. Counting is also not performed at Bonneville Dam during times of high shad passage (Starke and Dalen 1995). We will coordinate with WDFW to obtain 24-hour adult lamprey counts. Requests for inclusion of nighttime lamprey counting into the present fish counting program will be made to the U.S. Army Corps of Engineers.

The National Marine Fisheries Service has shown that about 50% of radio tagged Pacific lamprey that reach the face of Bonneville Dam are never detected inside the fishways. This work was replicated over three years of radio telemetry studies concentrating at Bonneville Dam (Vella and Stuehrenberg 1996; 1997; 1998). Though the NMFS work focused on Bonneville Dam Passage, they also tracked Pacific lamprey over The Dalles, John Day, and McNary Dams with similar results. With respect to downstream migration of lamprey smolts, the USCOE has documented impingement of considerable numbers of lamprey smolts on traveling screens (Starke and Dalen 1995); particularly the new extended length screens (Jackson et al. 1997). This indicates that hydrosystem effects on

lamprey are considerable and restoration efforts may hinge on our ability to determine and solve lamprey passage problems.

Work in FY 1999 will explore the use of an alternative lamprey passage system. Pending results from the FY 1999 work, we propose to further expand the development of this system in FY 2000, or test and evaluate alternative approaches to increase adult Pacific lamprey passage. These approaches may include providing resting and attachment areas for passing lamprey. Our work will be coordinated with the University of Idaho who is the lead group contracted by USCOE to investigate lamprey passage.

There are many problems with relying on the adult lamprey counts at the mainstem dams to determine population abundance and trends. For example, lamprey using alternate routes (e.g. slipping through the picketed leads at counting stations, Starke and Dalen 1995) and using the navigation locks (Mullan et al.1986) reduces validity of window counts. We propose to apply a mark/recapture method to estimate adult lamprey at the John Day Dam. Pending the results of the FY 1999 mark/recapture feasibility study, we propose to expand the amount of time to include the whole migration period from April to September. Upon approval, we will install modified portable assessment traps for collecting migrating adult lampreys. Portable assessment traps are used extensively in the Great Lakes Region for sea lamprey (*Petromyzon marinus*) capture. Trap placement will be located near the entrance of north and south fishways at John Day Dam. We will utilize exiting knowledge of lamprey movement and behavior at mainstem dams from the latest NMFS studies (Vella and Stuehrenberg 1996; 1997; 1998) for trap placement. Lampreys will be collected and counted daily from April through September. Lampreys will be marked with Denison colored tags specific for time and capture location. The dorsal fin will also be marked as a secondary identifier. Marked lampreys will be transported downstream from the dam and released. The number of lampreys recaptured will be documented daily. A population estimate will be made using the Schaefer method described in Purvis and MacDonald (1987).

Objective 2: Continue to develop a Pacific lamprey restoration management plan for the Umatilla River in NE Oregon.

Approach: The overall goal of the lamprey research and restoration project is to restore lamprey populations through implementation of various subbasin restoration plans. To initiate the restoration effort, CTUIR began restoration plan development in 1998 and will implement a pilot project in the Umatilla River beginning in 1999. Additional information such as past and current lamprey abundance, limiting habitat factors, donor stock availability, genetic database, disease database, migratory pheromones and homing information will be considered in the continued development of the plan. During 1998 we have accomplished some of these tasks such as historical abundance, distribution, current larval assessment (densities), and total adult counts (videography at Three-Mile Dam), in the Umatilla River. The plan should be considered a working document with the flexibility of adding new knowledge. Staff from the CTUIR with coordination of appropriate agencies will develop the restoration plan for the Umatilla River. Literature reviews and interviews will be conducted in order to integrate

all existing knowledge on lamprey handling, transport, spawning, and outplanting of larvae. A monitoring and evaluation section is included in the plan for adaptive management. Lamprey restoration will begin in 1999 after review from Oregon Department of Fish and Wildlife and other appropriate agencies.

Objective 3: Conduct pilot tests to address critical uncertainties and begin implementation of the Umatilla River Pacific lamprey restoration plan.

Approach: We propose to test the following constraints regarding lamprey restoration in the Umatilla River.

1.) Will adults collected from the wild survive to spawn?
2.) Will spawning produce viable eggs?
3.) Can we incubate and hatch eggs and rear prolarvae to burrowing stage?
4.) Will prolarvae outplants survive in the Umatilla River?

One critical constraint to restoration is developing methods to provide sufficient numbers of lampreys for supplementation. Pacific lamprey have been held in captivity for up to two years (Whyte et al. 1993; Close unpublished data). However, the methods to induce sea lamprey spawning (Fredricks and Seelye 1995; Manion and Hanson 1980), incubate eggs to burrowing stage (Piavis 1961), and outplanting (Manion and McLain 1971) have not been tested for Pacific lamprey. It is believed that artificial spawning and outplanting prolarvae will provide more individuals than outplanting adults to spawn naturally (Seelye personal communication 1998). In 1998, CTUIR collected 40 adult lamprey from Tumwater Falls in the lower John Day River and transported them to the U.S. Geological Survey-Biological Resources Division, Columbia River Research Laboratory located in Cook, Washington in order to calibrate methods. This effort will begin to provide hands-on learning regarding the constraints involved in lamprey restoration. A preliminary study in FY 1999 for calibrating methods to induce ripeness, manually spawn, incubate eggs, and outplant prolarvae for the Umatilla River is underway. The 40 adult lamprey collected will be spawned in 1999. Eggs will be reared for three to four weeks or until prolarvae are at the burrowing stage (Piavis 1961). Prolarvae will then be transferred to the Umatilla River for outplanting. Outplanting larvae in 1999 into our 43 index plots (7.5 m^2) will be our first attempt at increasing larval densities in the Umatilla River. By outplanting to specific locations on the Umatilla River where no larvae have been found in previous surveys, we will be able to monitor densities, growth, distribution, and survival of outplants. A portion of the FY 1999 outplants will be placed in fine mesh cages partially buried in the index sites in order to facilitate periodic monitoring of survival and growth to test the suitability of sites.

During the FY 1999 we will capture 100 adult lamprey from the Tumwater Falls on the John Day River and transfer to the Columbia River Research Laboratory in Cook, Washington for outplanting studies in the year 2000. Information will be directly applied to the Umatilla River lamprey restoration plan.

In a collaborative effort with Oregon Department of Fish and Wildlife, we propose to estimate Pacific lamprey smolt yield, outmigration timing, and age structure in the Umatilla River. Currently, rotary screw traps have been primarily used for estimating salmonid abundance in the Umatilla River. Van de Wetering (1998) successfully utilized this method for capturing and estimating lamprey outmigrants in a small coastal stream of Oregon. Floating inclined plane traps are another tool for estimating lamprey outmigrants (Beamish and Levings 1991). During FY 1999, we will begin to estimate smolt yield by releasing marked smolts above the trap to estimate trap efficiencies. Sue Knapp (ODFW) will operate the rotary screw trap with assistance from CTUIR. Beginning in 1994, data on larvae and lamprey smolts were collected with the rotary screw trap operated by ODFW in the Umatilla. However, it was not until 1997 that ODFW started separating lamprey smolts from larvae. By estimating current levels of outmigrating lamprey smolts, we hypothesize that smolt numbers will increase within 4-6 years (Kan 1975) of our initial outplanting.

The working hypothesis is that an increase in larval densities will increase the levels of the migratory pheromone petromyzonol sulfate (Li et al. 1995). A collaborative effort between CTUIR and Dr. Peter Sorensen at the University of Minnesota in 1998 determined that gall bladders of larval Pacific and western brook lamprey contain petromyzonol sulfate, which had been first discovered in sea lamprey. It was also determined that the adult Pacific lamprey olfactory system detects petromyzonol sulfate at a sensitivity close to that of sea lamprey. We hypothesize that an increase in concentration of petromyzonol sulfate in the Umatilla River will attract adult Pacific lamprey migrating in the Columbia River. We propose collection of water samples in the Umatilla and John Day Rivers to determine petromyzonol sulfate levels. The John Day River appears to have a relatively large abundance of larval production, whereas the Umatilla River could be considered functionally extinct (only 5 adults counted at Three Mile Dam and 8 larvae collected during all electrofishing in 1998). A continued effort of water sampling and analysis in FY 2000 will help determine factors associated with the attracting of adults into tributaries.

Concerns regarding the ability of Pacific lamprey to home to their natal stream has been identified as a critical uncertainty. We have initiated a preliminary study in 1998 on the lower Columbia River to begin to address this question. Lampreys were captured, radio tagged, and removed from capture locations to test whether they have fidelity back to capture locations. Preliminary results are inconclusive; however, a much more intensive study is needed to provide evidence of homing to natal streams. Bergstedt and Seelye (1995) determined that sea lamprey do not home to their natal streams in the Great Lakes. The authors marked outmigrants in a specific stream and recaptured the adults during spawning phase. Many biologists suspected sea lampreys did not home due to the rapid colonization of the Great lakes . Pacific lamprey may share the same colonizing behavior. Farlinger and Beamish (1984) have documented the colonization by Pacific lamprey of new habitat in the Fraser River, British Columbia after removal of a barrier. Another approach to this question of homing or lack of homing is the hypotheses that there is no genetic difference among Pacific lamprey from different rivers. We are examining genetic differences within the Columbia River Basin and outside the Basin

using allozyme analysis with work to be completed in the spring of 1999. The results may be helpful in assessing whether Pacific lamprey in the Columbia River Basin consists of distinct stocks due to geographic or reproductive isolation. Columbia Basin lamprey may be a panmictic population as is the case for sea lamprey of the Great Lakes (Brussard et al. 1981). We will integrate findings into the Umatilla restoration plan.

Minimal information is known about age/length relationships of Columbia River Basin Pacific lamprey. Lampreys do have a calcified structure similar the otolith to verify age. Methods have been developed and validated for aging several species of lamprey by statoliths (Medland and Beamish 1987; Beamish and Medland 1988; Medland and Beamish 1991). Beamish and Levings (1991), Van de Wetering (1998) aged larval and metamorphosed Pacific lamprey using the statolith banding patterns. However, the method has not been validated in this species. Currently, only length frequency analysis has been applied to age Pacific larval lamprey in the Columbia and Snake Rivers (Kan 1975; Hammond 1979) which may be inaccurate (Beamish and Levings 1991; Van de Wetering 1998). We propose to validate the method of using the statolith to age Pacific and western brook lamprey. Larval lamprey will be collected by electrofishing and injected with the fluorochrome labeled oxytetracycline. To determine appropriate dosage we will follow the methods of Jebbink and Beamish (1995). Experiments will be conducted in the laboratory and in the natural river environment. CTUIR staff will learn the aging technique from Dr. Beamish using Pacific and western brook larvae to apply in project streams. Better understanding of larval growth is needed to help determine stream productivity. This knowledge will be utilized in developing growth rates of larvae outplanted in the Umatilla River Basin and other ceded rivers.

Objective 4. Document current presence and distribution of larval lamprey in the John Day, Grande Ronde, Tucannon, and Walla Walla subbasins for future restoration needs.

Approach: Currently, little information is known about lamprey populations in Northeast Oregon/SE Washington tributaries (Jackson et al.1997, Jackson et al. 1998). To better understand existing populations, lamprey presence will be analyzed by review of all existing efforts that involve sampling/counting fisheries populations. Coordination will be made with agencies to provide these data. Field sampling, using the AbP-2 Backpack electroshocker, will be conducted to further document lamprey presence and relative abundance. The AbP-2 electrofisher has become the standard for assessing larval lamprey populations in the Great Lakes Region by various agencies since 1991 (Weisser 1994). Some juvenile western brook (*L. richardsoni*) and Pacific lamprey will be collected for validating the statolith method for aging. (See objective 3). Current Pacific lamprey presence, relative abundance, and distribution data from these rivers will be a critical component for development of additional subbasin lamprey restoration plans.

g. Facilities and equipment

Office Space and Equipment includes: one office work area; two desks, chairs and file cabinets, one book shelf, two Pentium computers with current hardware, software, and

printers, one IBM Thinkpad 760EL laptop portable computer with current software, and two locking indoor storage areas.

GSA Vehicle and Fenced Lot includes: one Ford extended-cab pickup with 8000-pound winch. A fenced lot with locking gates is available for storage needs.

Field Equipment includes: two AbP-2 Wisconsin backpack electroshockers with batteries and chargers, one Smith-Root model 12-B backpack electroshocker with batteries and charger, four portable assessment traps, waders, raingear, and hand tools.

Cameras and Instruments includes: two Panasonic Desktop Editor VCR, and monitors, one 35mm camera.

Contracted Expertise and Laboratory Services: contracting with established genetic researchers and laboratories will provide the needed expertise and equipment for quality genetic evaluations. In addition, CTUIR will be contracting with staff from USGS/BRD-CRRL for needed expertise and equipment for laboratory testing of methods for supplementation. CTUIR will also be contracting with University of Minnesota to examine migratory pheromones.

h. Budget

Personnel costs are based on the equivalent of 4.25 full-time employees. However, a number of employees only work part-time on this project. Wages are set and follow similar range and step schedule as federal employees. Increases in personnel costs occur each year through cost of living adjustments (COLA). COLA rates are based on inflation. Wage step-increases will stop within several years, as most employees will reach their maximum step. Our estimates for out-year costs reflect the COLA and step changes. Fringe benefits and indirect costs (29% and 34% respectively) are set by CTUIR administration and cannot be changed at the program or project level. Cost for services and supplies are higher than previous years and include field materials, lab fees, communications, computer supplies, office supplies, and equipment repair/maintenance. The travel budget is primarily for GSA vehicles (rental, mileage, and insurance). Travel also includes per diem for personnel for data gathering, research, training, and attending conferences/meetings. Three subcontracts with are planned for FY 2000 (CRITFC, USGS/BRD-CRRL, and University of Minnesota). CRITFC will continue to assist in research regarding adult lamprey passage at mainstem dams. CRRL will assist CTUIR with expertise and laboratory research regarding supplementation methods. The University of Minnesota will provide continued expertise and laboratory analysis of migratory pheromones. These subcontracts will last for one year and may be renewed depending on research needs.

Section 9. Key personnel

Name: Gary A. James
Title: Fisheries Program Manager

Months funded this project: 1
Education: B.S. Fisheries 1979 Oregon State University
Experience: 20 years fisheries experience; last 15 years CTUIR Program Manager; expertise in multi-project fisheries program development, coordination, and oversight.

Name: David A. Close
Title: Fishery Biologist, Lamprey Project Leader
Months funded this project: 12
Education: A.A. Libreral Arts. Blue Mountain Community College.1991
B.S. Fishery Resources. University of Idaho. 1994.
M.S. Fisheries Science. Oregon State University. Pending 1999
Experience: Fisheries Technician, Confederated Tribes of the Umatilla Indian Reservation. Part-time 1988-1990.
Fisheries Supervisor Technician, United States Forest Service. Summer 1991
Fisheries Technician, Columbia River InterTribal Fish Commission. Summer 1992.
Fisheries Technician, Confederated Tribes of the Umatilla Indian Reservation. Summer 1993.
Fisheries Biologist, USGS/BRD, Columbia River Research Laboratory. Summer 1994.
Graduate Research Assistant, Pacific lamprey research, Oregon State University, 1994-1998.
Fishery Biologist, Lamprey Project Leader, Confederated Tribes of the Umatilla Indian Reservation. 1998 to present.

Name: Aaron D. Jackson
Title: Fisheries Technician
Months funded this project: 12
Education: High School Diploma
A..A. Blue Mountain Community College. Pending 2002
Experience: Fisheries Technician, Confederated Tribes of the Umatilla Indian Reservation. Part-time in 1994, Full-time 1995 to present. 2 years Natural Production project, 3 years Lamprey Project experience.

Section 10. Information/technology transfer

Project reports of accomplishments are produced quarterly and annually. Project personnel also participate in a Columbia Basin Pacific lamprey work group to share findings and discuss information needs. Project personnel also participate in local public forums to communicate lamprey project status.

Congratulations!